received the smaller proportionate quantity of rain,—an unexpected result, which deserves confirmation. It appears also that the gauge inclined 45°, and turned to the wind, received more rain than the horizontal gauge; and that the quantity collected in the globular gauge was about intermediate between that of the twelve-inch horizontal and inclined funnels. From this Mr. Atkinson imagined, that its indications were more nearly proportioned to the real quantity of rain than either of the others; but it probably did not expose a sufficient arc (it should be 270°). Having pointed out these circumstances affecting the true meaning of correctly-observed rain-registers, Mr. Phillips drew attention to the importance, in all these inquiries, of a knowledge of the angle of inclination of descending rain in each shower, and concluded by proposing, as a fit general form of experimental research, so far as the mere question of the *quantity* of rain falling through given sections of air at different heights was concerned, that there should be placed in some very unexceptionably open situation a series of gauges at different heights above the surface (0, 3, 6, 12, 24 French feet), of *three kinds* at each height, viz. an ordinary *funnel*-gauge with horizontal edge; a *globular* gauge; an *azimuth- and inclination*-gauge, such as was described by the Author, and illustrated by figures in the account of the proceedings of the Section at Glasgow.

Notice of a Meteorological Journal for the Year 1840, *kept by* John Campbell Lees, *at Nassau, New Providence.*

Letter from the late Capt. Hewett to Capt. Beaufort, R.N. (referred to in a communication by Professor Whewell).

H.M. Ship Fairy, Harwich, August 31st, 1840.

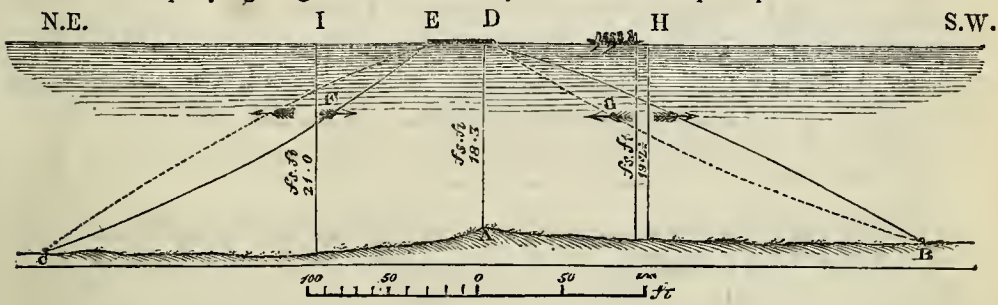
Sir,—On the 24th inst., being in lat. 52° 27′ 30″ N., long. 3° 14′ 30″ E., with light breezes and smooth water, I deemed it a fitting opportunity for making a further trial on the rise and fall of tide in the middle of the North Sea; and although I was then many miles both to the northward and eastward of the spot near which Mr. Whewell had previously expressed his wishes that the experiment should be made, yet I thought that if good observations by any means could be obtained at the above position, they would at the least serve to show, in some measure, the truth or error of that gentleman's theory; either in the one case by a sensible diminution of the vertical movement of the tide, when compared with the known rise and fall on the shores of England and Holland, or in the other by ascertaining the rise and fall, beyond a doubt, to be so great as to throw some doubt on the correctness of the theory in question. But as I apprehend that Mr. Whewell's theory is founded mainly upon the fact, that the tide waves, to make high water on the opposite coasts of England and Holland, come from different directions, namely, on the former, round the northern extreme of Great Britain, and so working its way along the eastern coast; and on the latter, through the straits of Dover, and running thence along the coasts of France, Belgium and Holland; and that it might reasonably be inferred, that these waves gradually diminish in importance as they recede from their respective shores, or approach each other, there would be left a broadish space about the middle of this part of the North Sea, where no rise and fall of tide exists, and that therefore the waters between the two opposite shores would assume a convex form at low water by the shores, and a concave one at high water.

Allowing this view of the foundation of Mr. Whewell's theory to be correct, (and I have not his book at present near me to refer to,) this line, or more properly speaking, "broad belt" of no rise and fall, would doubtless run for a considerable distance in the north-easterly direction into the North Sea, from the point where it may commence on the North-Sea-side of the straits of Dover. It would therefore follow, that the fact of my being to the northward of Mr. Whewell's position would of itself be of no material importance, and by reference to the Chart, it will be seen that the longitude places me not many miles to the eastward of the "broad belt" above alluded to. Having thus reflected, I came to the conclusion, that if Mr. Whewell's views were correct, true observations made in this position would exhibit some indications thereof, and I accordingly made the necessary dispositions.

A rise and fall by the shore is a case which falls immediately on the conviction, by

the sense of sight; but to ascertain the fact of a vertical motion of five or six feet in the middle of a great sea, and out of sight of land, is a problem of no small difficulty, and requires the exercise of many precautions to arrive at anything like true results. In making an observation of this description we find two important obstacles in the way of obtaining these, namely, the stream of tide and the undulating character of the surface of the ground. Under the influence of a strong stream of tide, it is utterly impossible, except in very shallow water, to take a strictly correct depth from the vessel, or a boat, at anchor, (and therefore a fixed point,) for the line *will* assume a curved form in the act of descent; and after all, from the want of perpendicularity in the line, a large allowance, in a depth of nearly twenty fathoms, is necessarily left to the exercise of the judgment; and both of these may amount to considerably more than the "rise and fall" sought for. On the other hand, the undulations of the surface render it essential that the depths should be always taken *over* some discovered elevated spot. The stream of tide and the undulations of the ground are therefore alternately opposed to the making of observations from which correct results can be derived. I experienced on this, as on the former occasion, considerable difficulty in overcoming these obstacles; but I soon found myself compelled to resort to the former plan, (with the addition of such precautions as experience then gave me,) namely, that of mooring one boat and taking the depths in another.

The accompanying diagram will assist my account of the plan pursued.



The ship was anchored in 21½ fathoms, and on searching, a convenient rise in the ground A was soon found near her, over which there was exactly 18 fathoms 3 feet, by a well-measured line. The second gig (of 26 feet) was then moored, "head and stern," in the direction of the strength of the stream (N.E. and S.W.), so that she should be as nearly as possible over the overfall A. This was accomplished thus:—I prepared a coil of 1½ inch rope, and fastened a grapnel at either end. The first grapnel was let go at B, the whole of the line was then veered away, and the second grapnel was let go at C; the gig was hauled along the bight of the rope, until it was found, by repeated trial, that the summit of the overfall was exactly abreast the foremast row-lock of figure D, at about six feet from the boat, while the N.E. stream was running. She was there secured. At the turn of the tide to the S.W., it was found that the weight of the stream F had operated so powerfully on the bight of the N.E. line, as to draw the boat from D to E, so that the summit of the overfall, which was before under the foremost row-lock, was found to be eight feet on her bow. On the return of the N.E. tide, its operation (G) upon the bight of the S.W. line again drew the gig ahead to her former position D, and the summit of the overfall was found as before under the foremost row-lock.

It will then be evident, that at each change of tide I knew exactly where the overfall was to be found, while taking the depths; and thus prepared, it only remained to get the *least* and *exact vertical* depth over the summit of the overfall at the intervals determined upon, and which were every half-hour. With the N.E. stream running, I dropped the lead from the other gig about the point H, and exactly in the stream, which I knew would drift her at the proper distance of six feet from the moored boat; the lead was constantly lifted off the ground, so that the line was perfectly straight and perpendicular, and the undulations of the ground carefully observed until the lead passed over the summit of the overfall, where the depths were strictly noticed, and recorded in the accompanying Table. The boat on this stream was allowed to drift to the point I. With the S.W. stream I began about

August 24th, 1840. Moon's Age, 26·6 days. } Latitude 52° 27′ 30″ N. Longitude 3° 14′ 30″ E.

Times. P.M.	Depths.	Direct. (Comp.)	Rate.	Winds. (Comp.)	Force.	Remarks.
h. m.	fms. ft.		Kts. $\frac{1}{10}$s.			
1 0	18 3¼	N.E. ¼ E.	1 5	S.W.	2	
1 30	18 3	N.E.	1 4			
2 0	18 2¾	N.E. ½ N.	1 2			
2 30	18 2¾	N.E. ¾ N.	1 0			
3 0	18 2¾	N.E. by N.	0 7			
3 30	18 2	N.E.	0 5			
4 0	18 1	N.E. by E.	0 3			
4 30	18 1	East.	0 3			
5 0	18 1½	Slack.	0 0	S.S.W.		
5 30	18 2	W. by S.	0 3			
6 0	18 2½	S.W. by W.	0 7			
6 30	18 3	S.W. ½ W.	1 4	S. by W.		
7 0	18 3¼	.....	1 5	South.		
7 30	18 3½	.....	1 5	S.S.E.		
8 0	18 3½	.....	1 6	S.E. by S.		
8 30	Too dark for observations.					
9 0						
9 30						
10 0						
10 30						
11 0						
11 30						
12 0						
12 30						
1 0						

August 25th, 1840. Moon's Age, 27·6 days. } Latitude 52° 27′ 30″ N. Longitude 3° 14′ 30″ E.

Times. A.M.	Depths.	Direct. (Comp.)	Rate.	Winds. (Comp.)	Force.	Remarks.
h. m.	fms. ft.		Kts. $\frac{1}{10}$s.			
5 30	18 3	Slack.	0 0	Calm.	0	
6 0	18 3	S.W. by S.	0 5			
6 30	18 3	S.W.	0 7			
7 0	18 3	.....	1 0	W. by N.	1	
7 30	18 3	.....	1 3	.....	2	
8 0	18 3	.....	1 5			
8 30	18 3	.....	1 3			
9 0	18 3	.....	1 2			
9 30	18 3	.....	0 9			
10 0	18 3	.....	0 5			
10 30	18 3	S.W. by W.	0 2	.....	.....	Tide slack from 10·45 to 11·0.
11 0	18 3	Slack.	0 0	W. by S.		
11 30	18 3	N.E.	0 3			
12 Noon	18 4	.....	0 9			
P.M. 30	18 4	.....	1 3			
1 0	18 4	.....	1 6			
1 30	18 4	.....	1 6			
2 0	18 4	.....	1 6			
2 30	18 4	.....	1 6			
3 0	18 4	.....	1 3			
3 30	18 4	.....	1 0			
4 0	18 3½	.....	0 5			
4 30	18 4	.....	0 3	W.S.W.		
5 0	18 4	Slack.	0 0	S.W.		
5 30	18 4	S.W.	0 2			

(Signed) William Hewett, *Captain of H.M.S. Fairy, August 31st*, 1840.

the point I and terminated at H, using the same observances and precautions until 5h. 30m. P.M. of the 25th, when the appearance of the weather required my removing.

It will be seen that the observations recorded on the afternoon of the 24th are not so regular as those of the following day. I attribute this to some degree of *uncertainty* on account of a long swell, perhaps of one and a half or two feet rise, interrupting the observation at the moment of passing over the overfall; but this little swell had nearly subsided on the 25th, and the depths were then recorded with much satisfaction. It will also be noticed, that at the turn of the stream about noon of the latter day, the depth had increased to eighteen fathoms four feet, and went on uniformly so; but I investigated the cause of this on the spot, and found that the wind having increased to 2 from W. by S., and therefore operating upon the starboard bow of the boat, had sidled her a few feet to the S.E., so as to bring the eighteen fathoms three feet immediately under her; and that by observing the same distance from the boat while drifting past her (and which was always on her larboard side), I obtained eighteen fathoms four feet instead of eighteen fathoms three feet.

From the care and pains taken in these observations, and *that* under favourable circumstances, I do not entertain a doubt of the correctness of any one of the depths over the summit of the overfall as recorded on the 25th; but as this interesting result of observations on an unexpected theory may no doubt give rise to a strong desire for further observations as corroboratives, I shall not fail to make such when I find myself in a position and circumstances to do so with any prospect of success. It is a difficult observation, and can be made but seldom. In the mean time I would offer my congratulations to Mr. Whewell on these results, should they prove in any degree gratifying to him. I have the honour to be, &c.

(Signed) WILLIAM HEWETT, *Captain.*

On a Machine for Calculating the Numerical Values of Definite Integrals. By the Rev. HENRY MOSELEY, *M.A., F.R.S., Professor of Natural Philosophy and Astronomy in King's College, London.*

It is the object of this machine to apply to the mechanical integration of an extensive class of functions, a principle suggested by M. Poncelet for the registration of dynamometrical admeasurements, and subsequently applied by M. Morin to an instrument called the Compteur, for registering the work or dynamical effect expended in the traction of loaded carriages upon common roads, and by a Committee of this Association (whose Report is contained in the present volume) to a permanent registration of the work of the steam upon the piston of a steam-engine. Professor Moseley stated his integrating machine to have some mechanical expedients in common with the last-mentioned machine, but to have nothing in common with the Compteur of M. Morin, except the fruitful and admirable principle of M. Poncelet.

It consists of a circular plate or disc placed in a horizontal position, and moveable about an axis passing through its centre. A wheel, which, from the function assigned to it, Professor Moseley calls the integrating wheel of his machine, is placed in a vertical position with its edges resting upon the superior surface of this plate, and with its axis (*i. e.* a line passing through its centre perpendicular to its plane) in a vertical plane passing through the centre of the plane. It is made to retain this vertical position, and at the same time to admit of a motion across the plate on which it rests, in the direction of a diameter, by the intervention of a guide composed of three parallel rods passing through three holes at corresponding points in the three arms of the integrating wheel and fixed at their extremities firmly into two discs, which discs are moveable about axes passing through their centres, these horizontal axes having their bearings in two pieces which admit of a vertical motion by means of keyed grooves in guides fixed vertically to the solid frame on which the plate rests; so that the whole weight of the frame and integrating wheel is borne by that point in the circumference of the latter by which it rests on the plate: the frame composed of the three parallel rods, and the discs into which they are fixed, is perfectly rigid, and is carried round by the revolutions of the integrating wheel; and the axes about which it turns being in a vertical plane passing through the centre of the plate, the frame